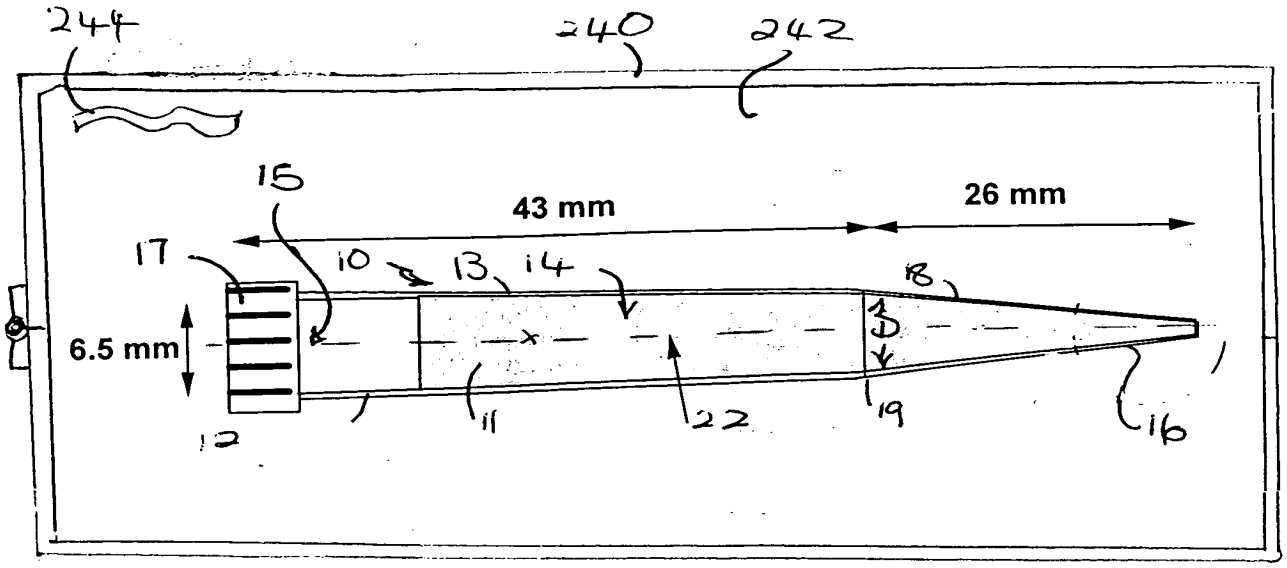

244
240
242
15
43 mm
26 mm
17
10
13
14
18
6.5 mm
D
12
11
22
19
16

FIG. 1

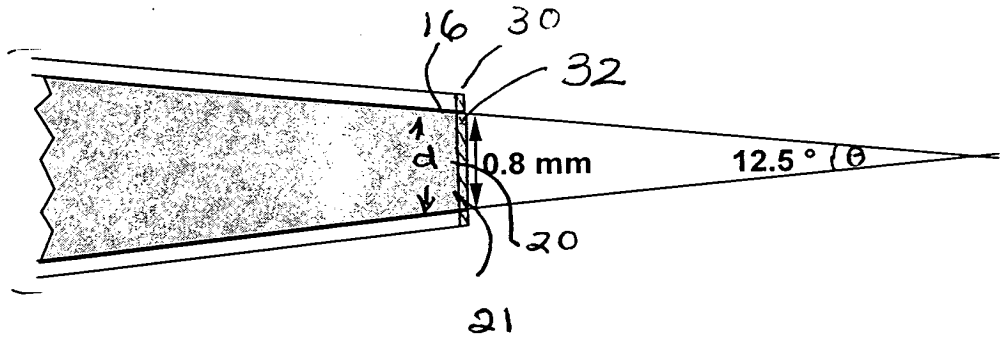

16
30
32
d
0.8 mm
12.5 °
θ
20
21

FIG. 2

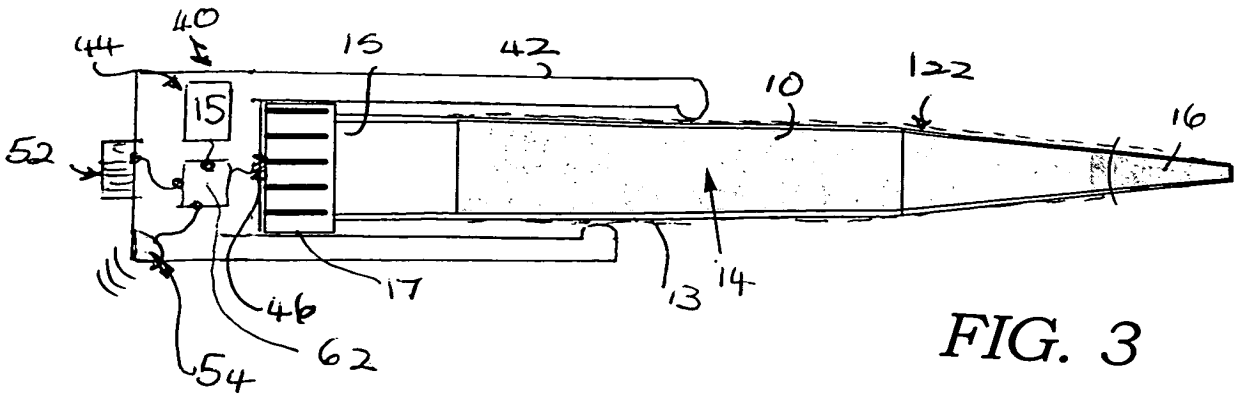


FIG. 3

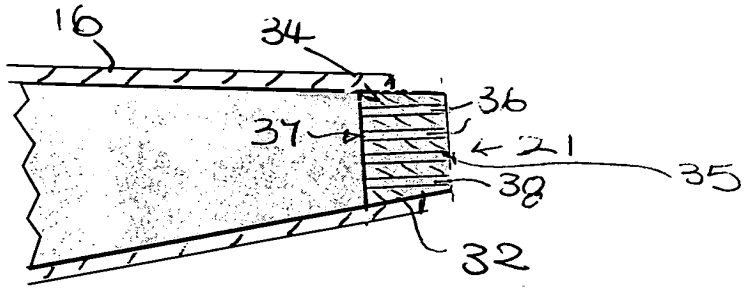


FIG. 4

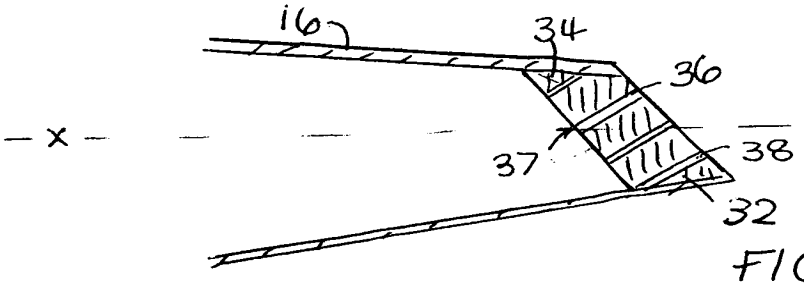


FIG 4A

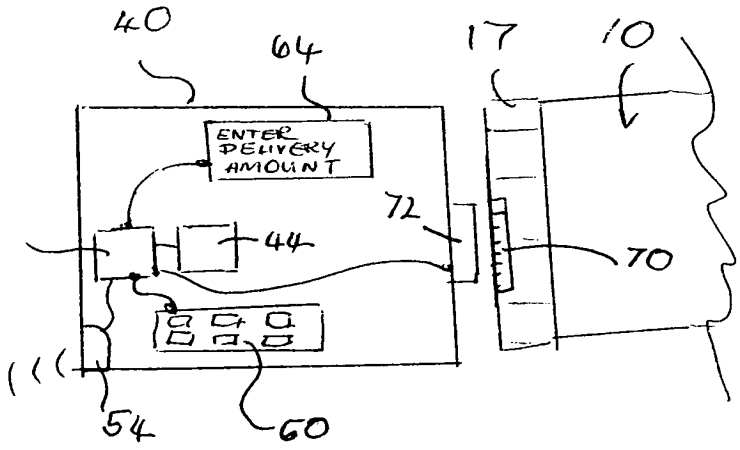


FIG. 6

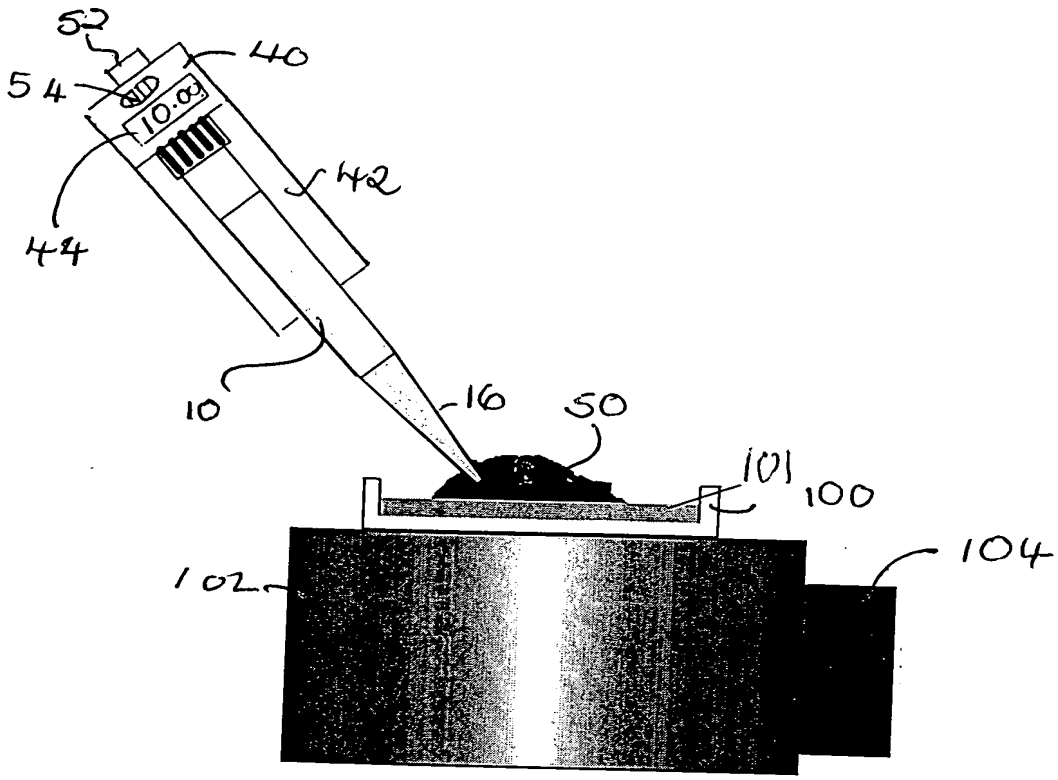


FIG. 5

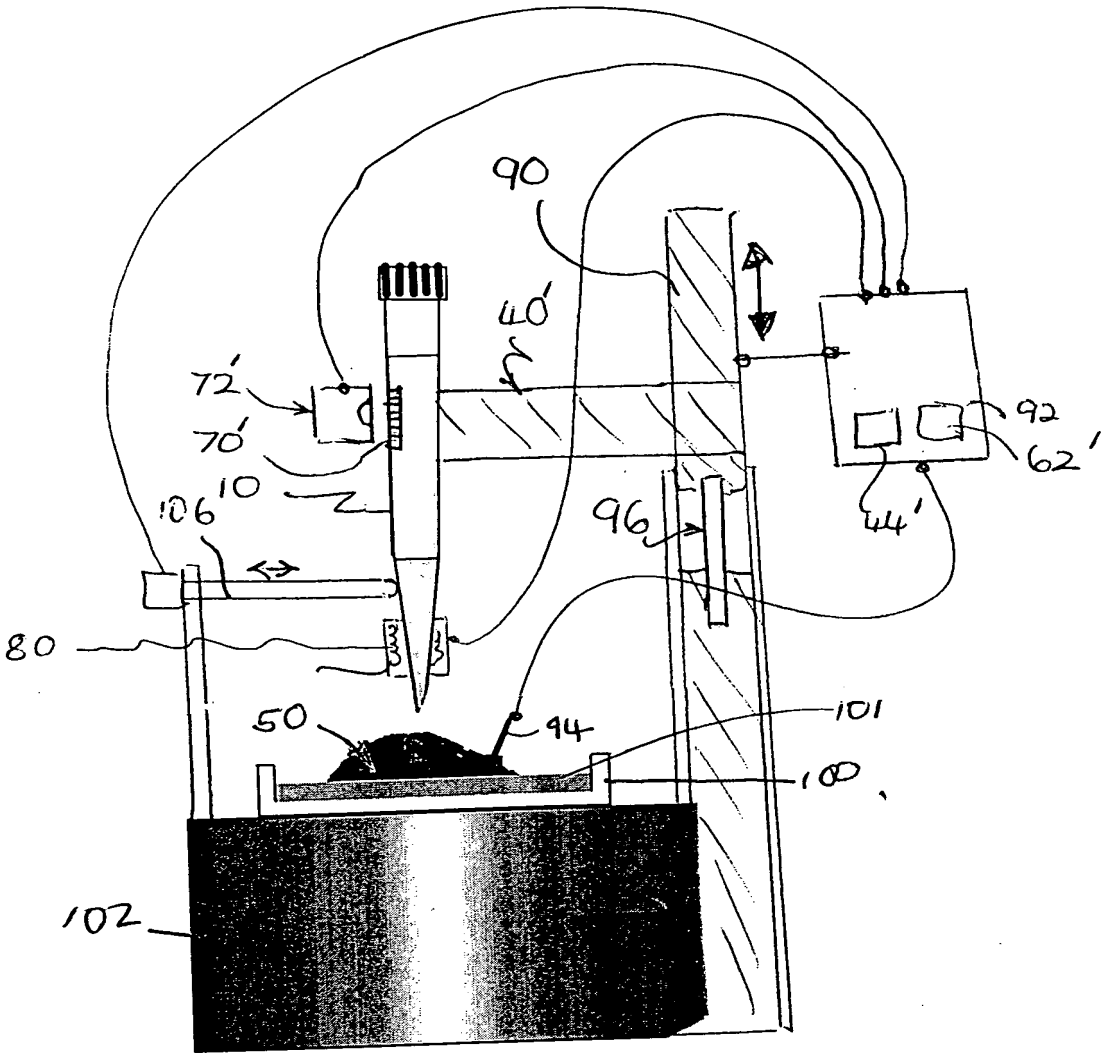


FIG. 7

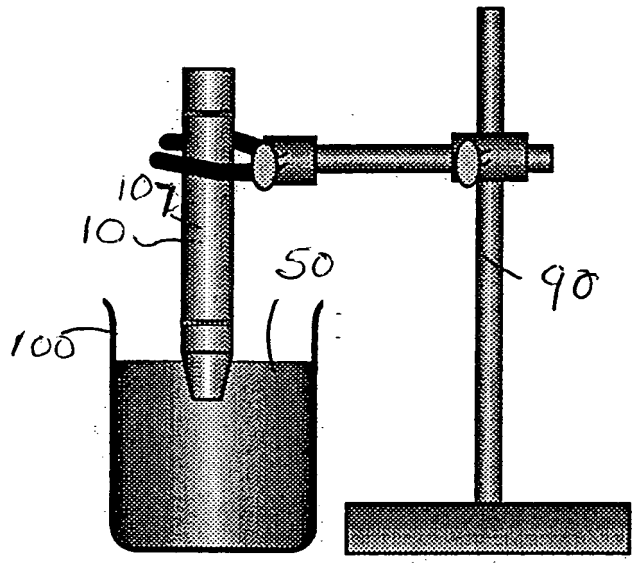


FIG. 8

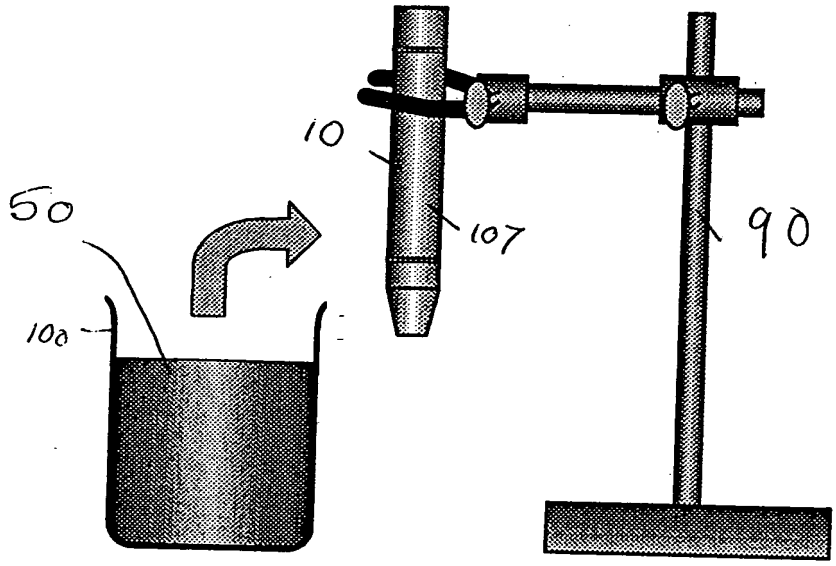


FIG. 9

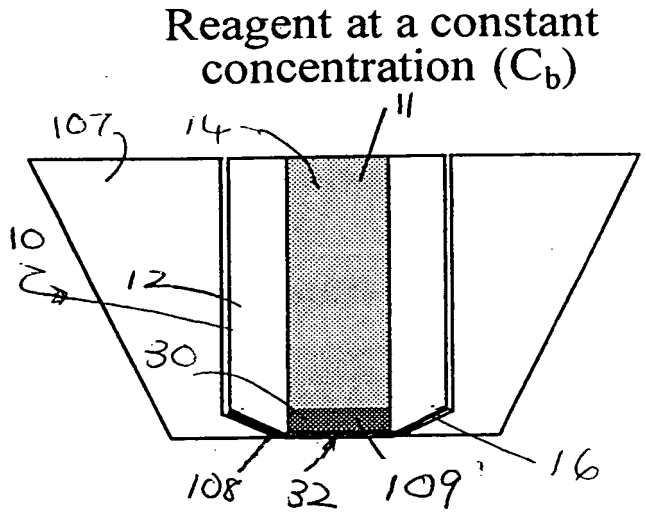

Reagent at a constant concentration (C_b)
107
14
11
10
12
30
108
32
109
16

FIG. 10

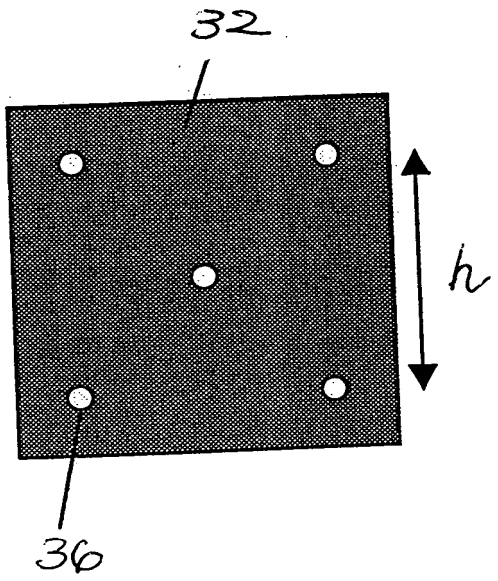

32
h
36

FIG. 11

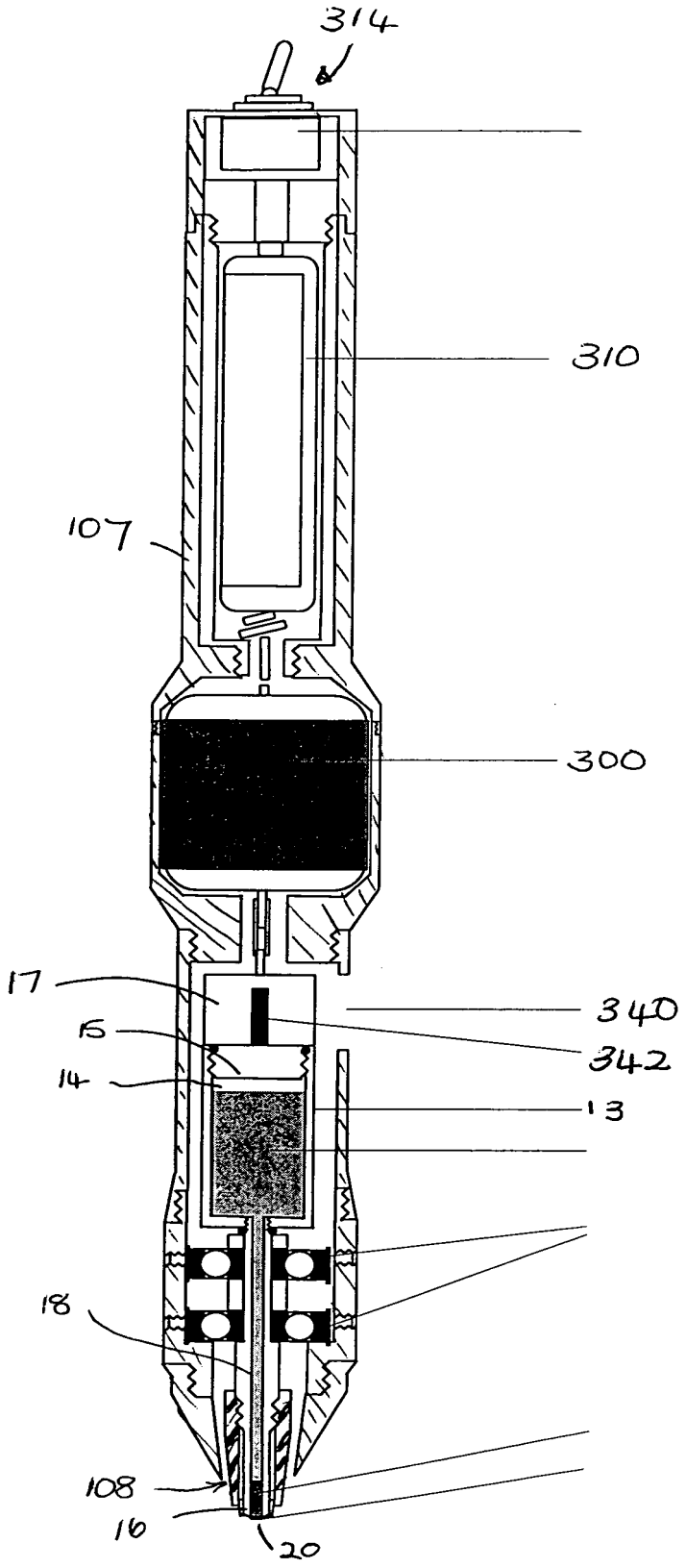


FIG. 12

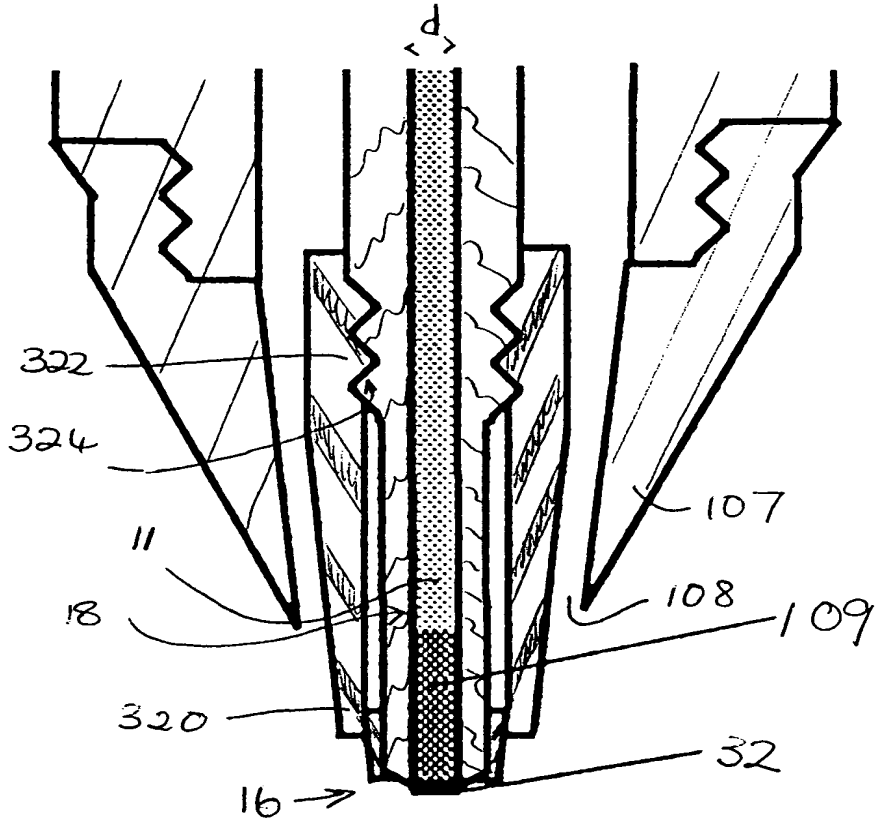


FIG. 12A

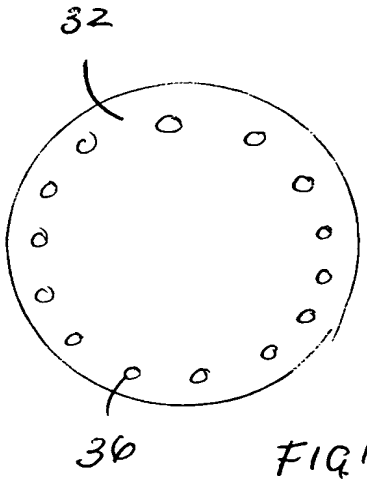


FIG 12B

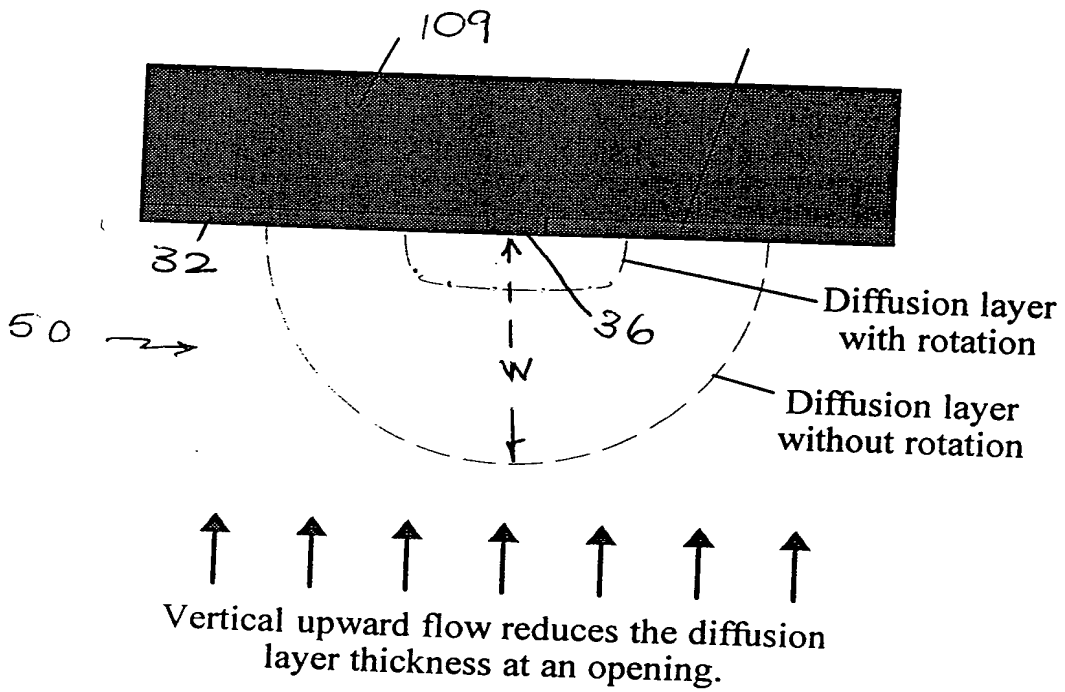

109
32
50
36
W
Diffusion layer with rotation
Diffusion layer without rotation
Vertical upward flow reduces the diffusion layer thickness at an opening.

FIG. 13

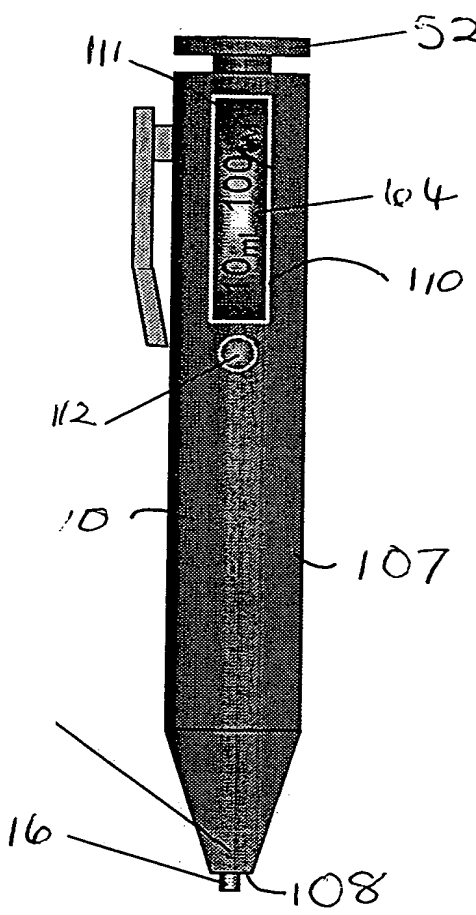


Fig. 14

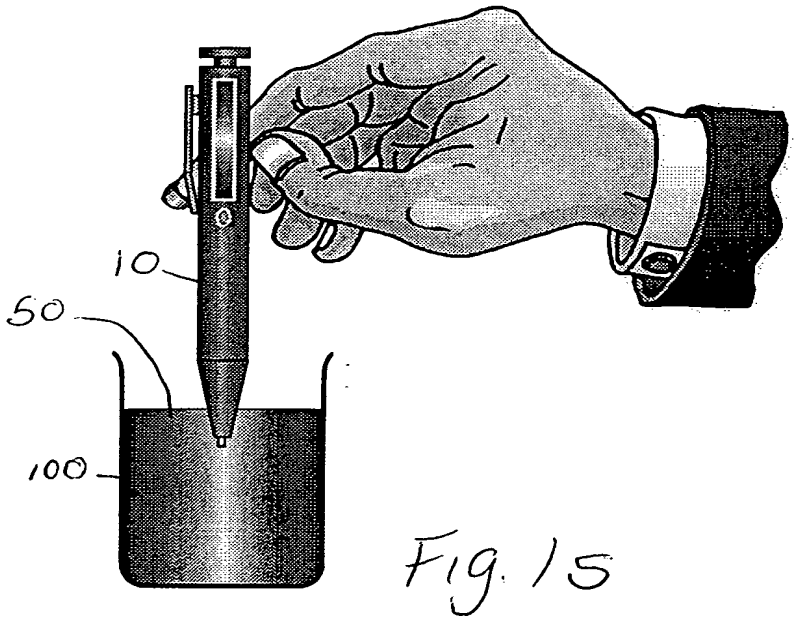


Fig. 15

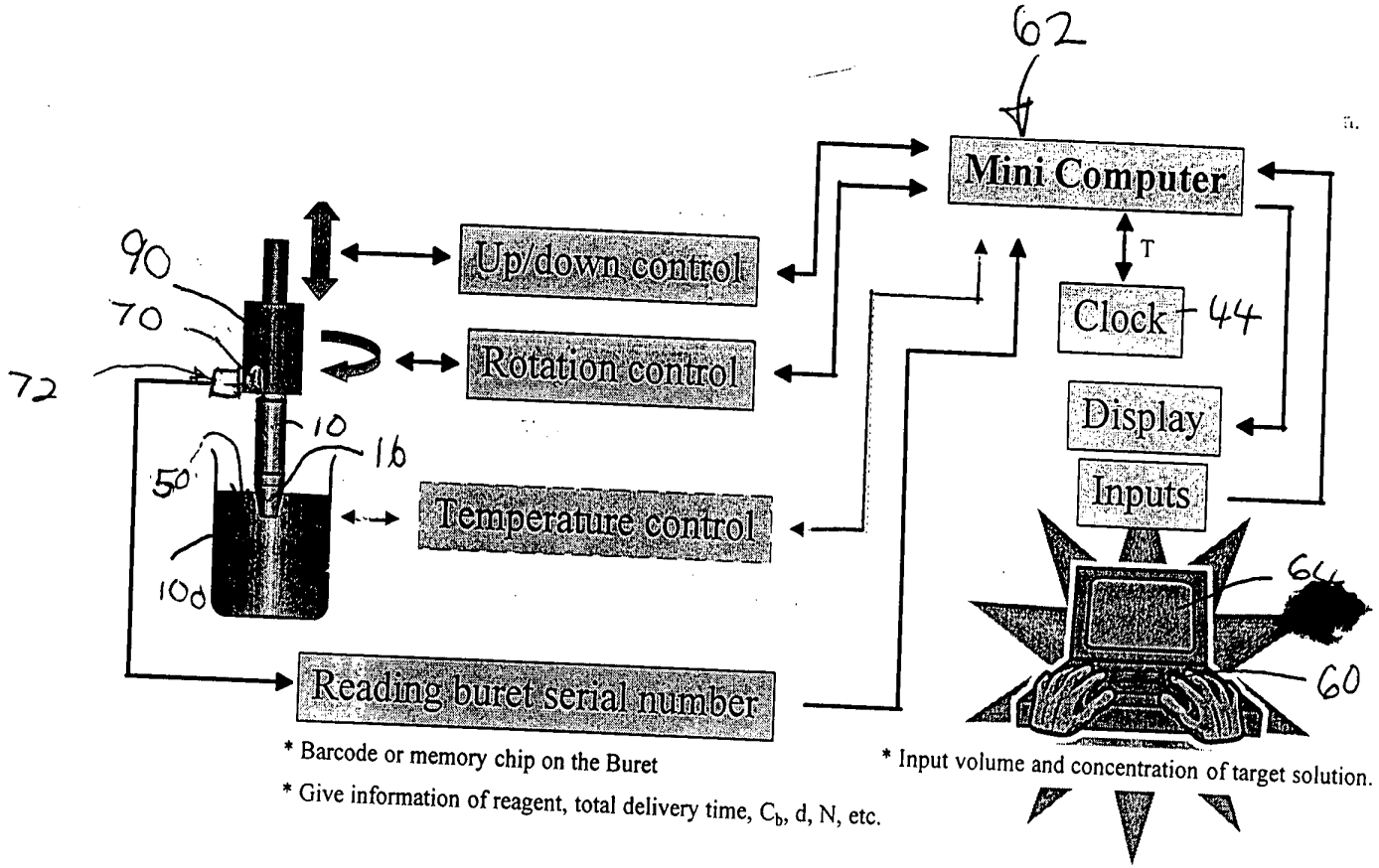

62
Mini Computer
T
Clock
44
Up/down control
Rotation control
Temperature control
Reading buret serial number
Display
Inputs
64
60
90
70
72
10
16
50
10d
* Barcode or memory chip on the Buret
* Give information of reagent, total delivery time, C_b, d, N, etc.
* Input volume and concentration of target solution.

FIG 16

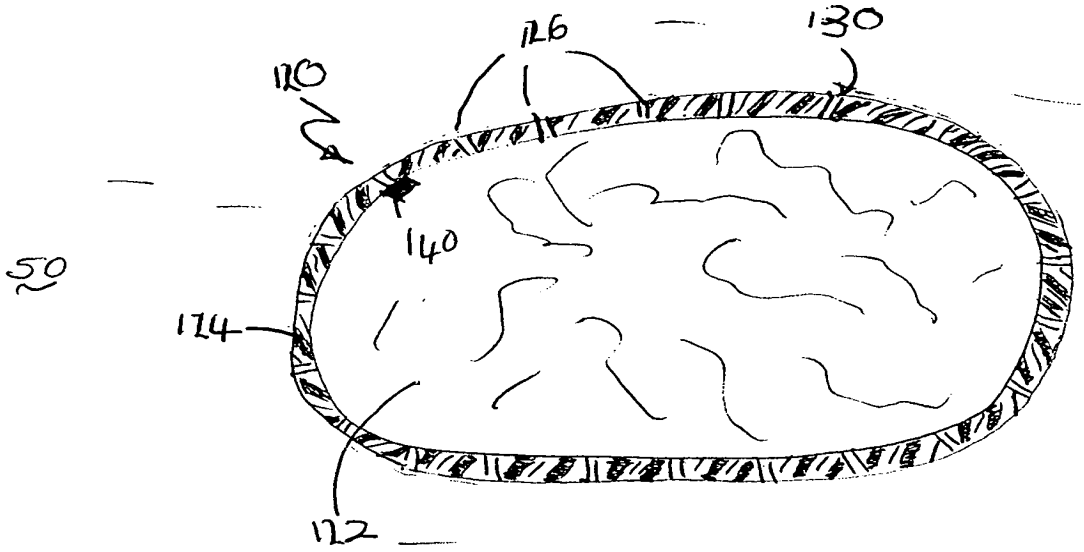


FIG. 17

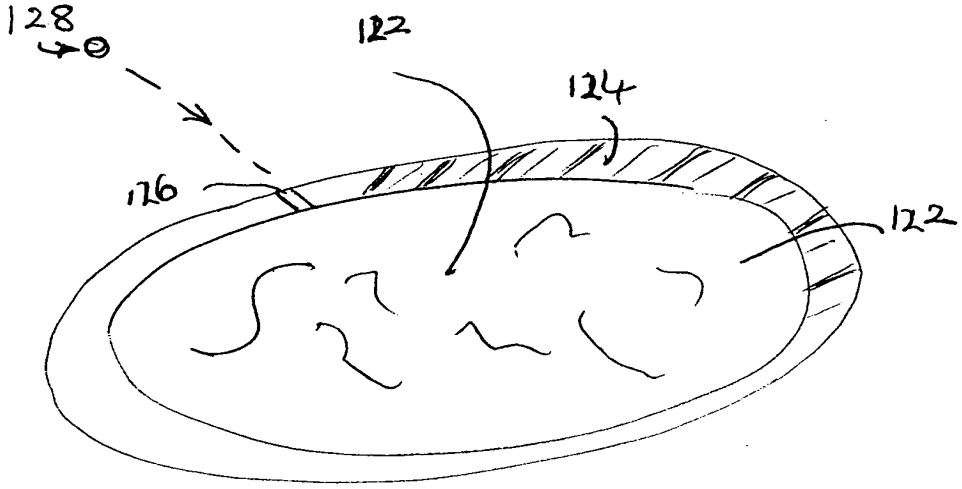


FIG 18

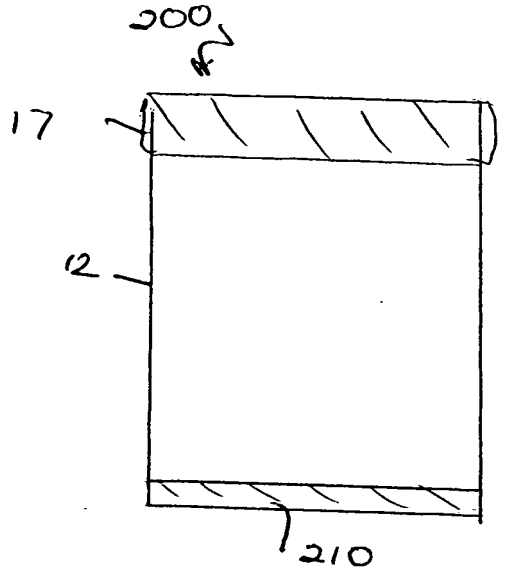


FIG. 9

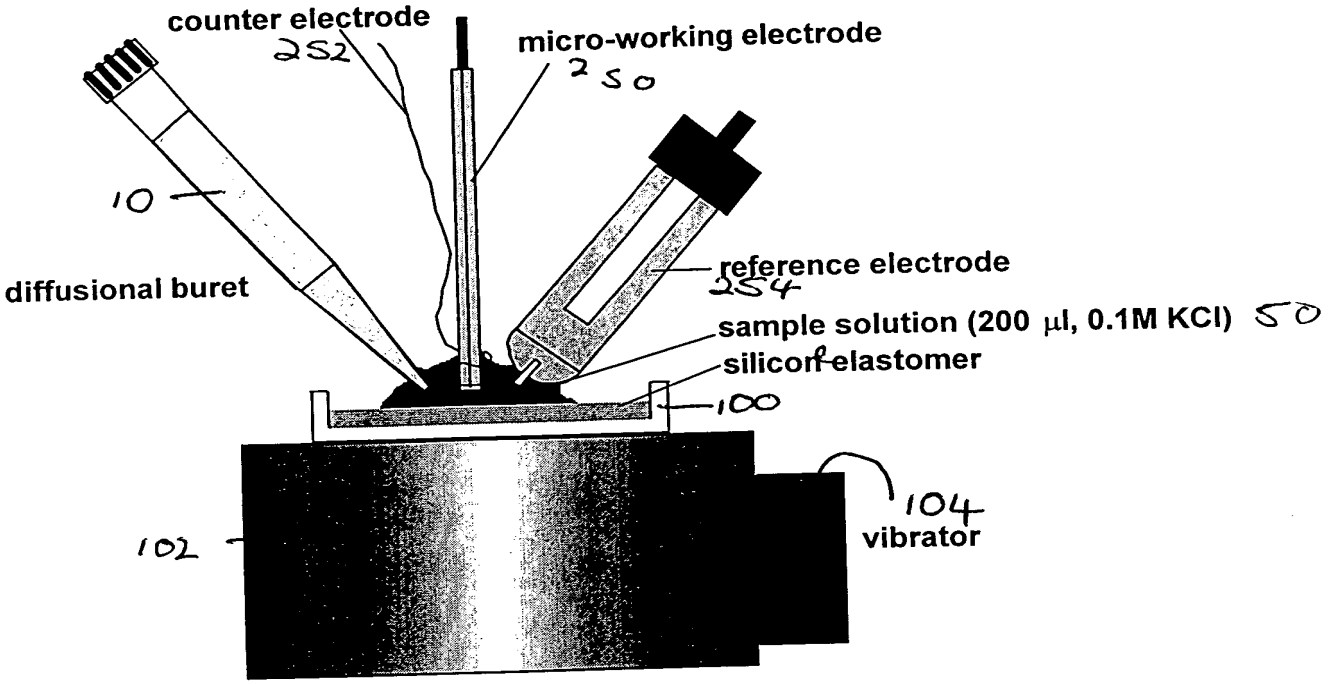

counter electrode
252
micro-working electrode
250
10
diffusional buret
reference electrode
254
sample solution (200 μl, 0.1M KCl) 50
silicon elastomer
100
104
vibrator
102

FIG. 20

Cyclic voltammograms of $[Fe(CN)_6]^{3-}$ with various reagent delivery times

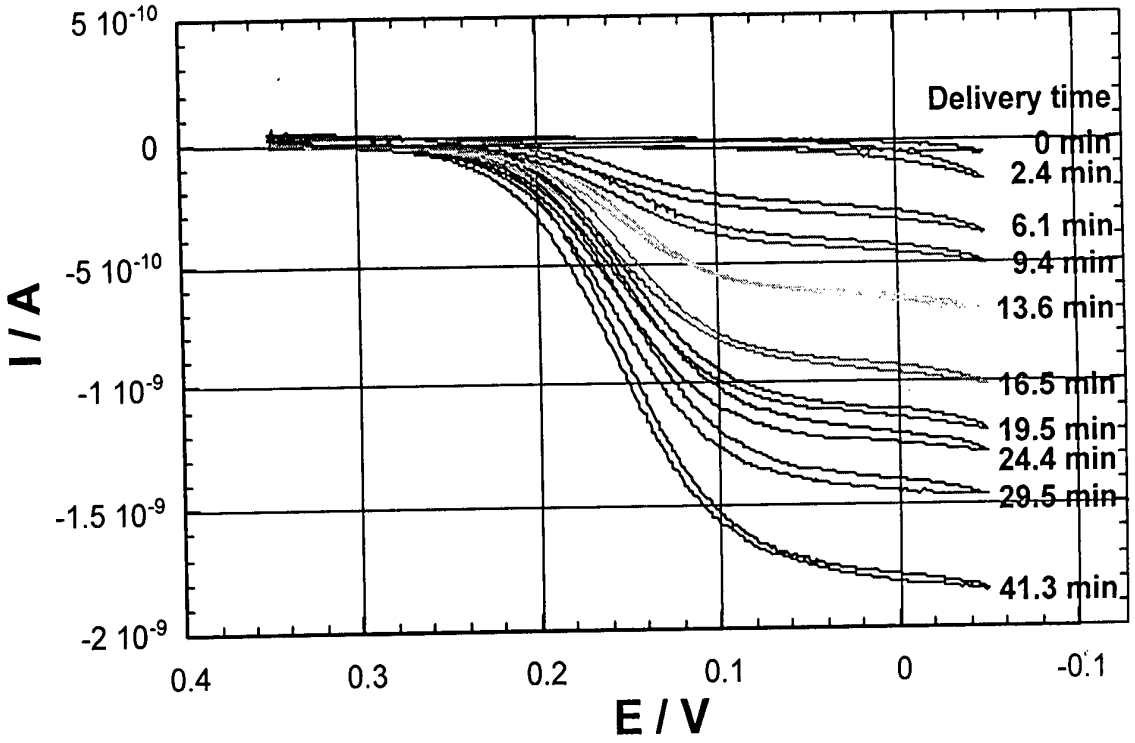


FIG. 21

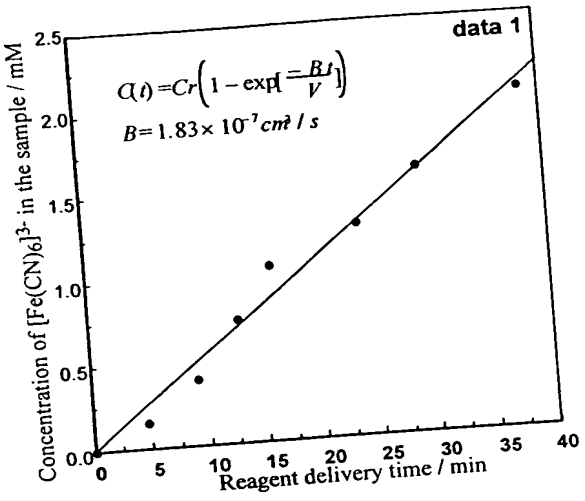


FIG. 22A

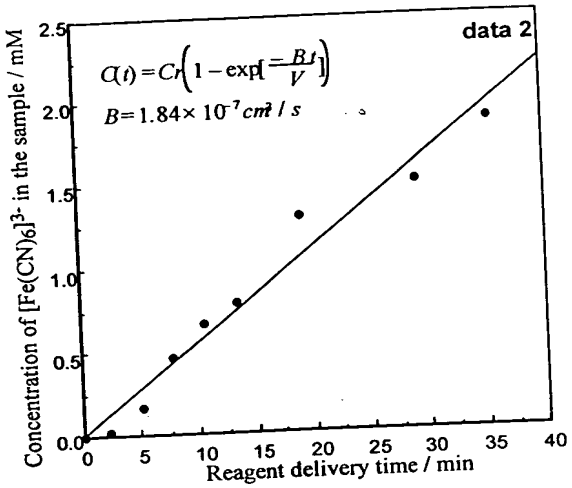


FIG. 22B

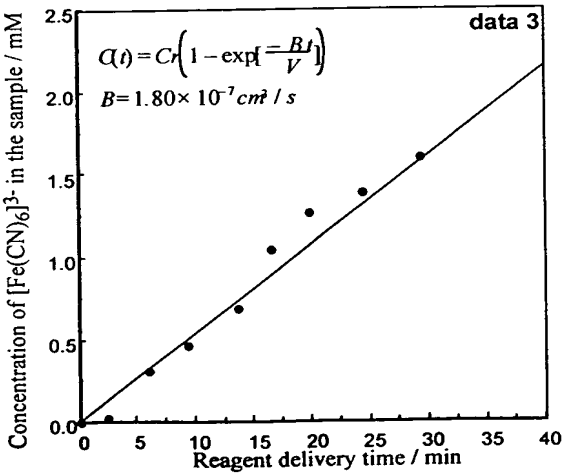


FIG. 22C

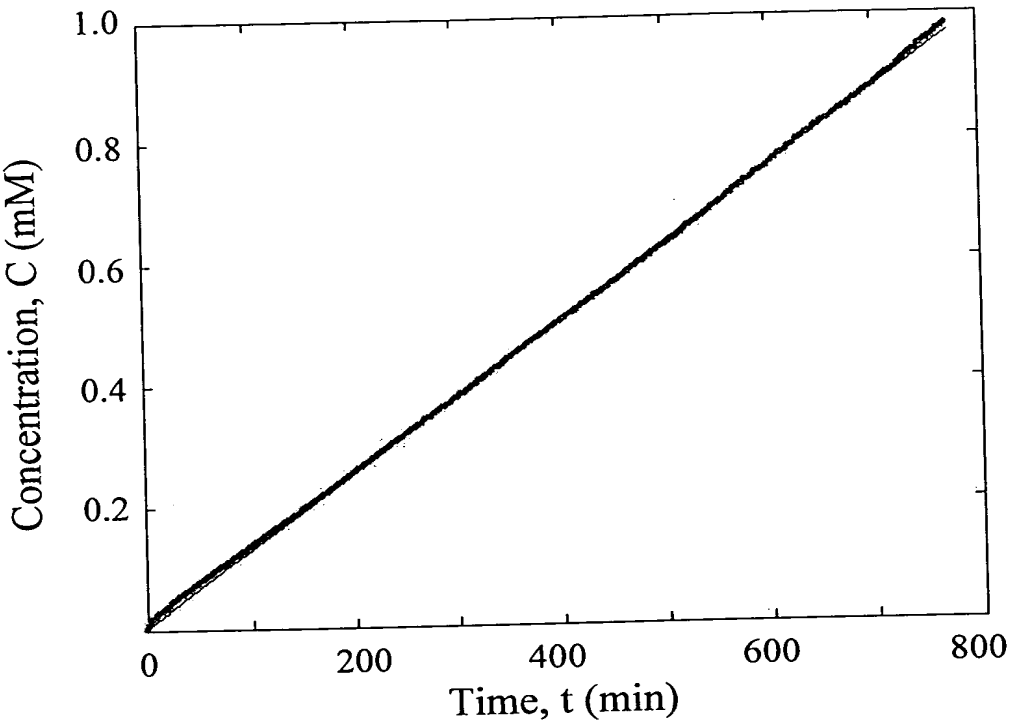
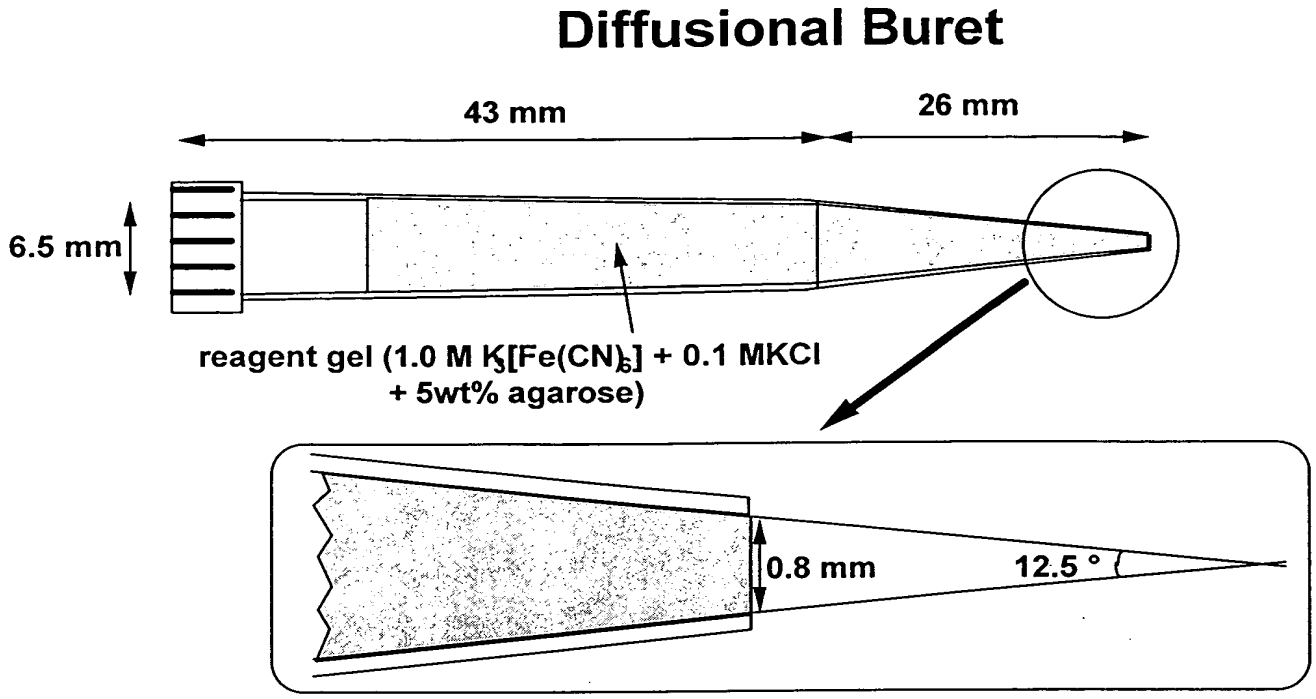


FIG. 23

FIG. 24



$$C(t) = Cr\left(1 - \exp[\frac{-Bt}{V}]\right)$$

$$B \approx D\, r\, \pi \tan\theta$$

$$D = 7.3 \times 10^{-6} cm^2 / s$$

$$r = 0.04\ cm$$

$$\theta = 12.5°$$

$$B = 2.03 \times 10^{-7} cm^3 / s$$

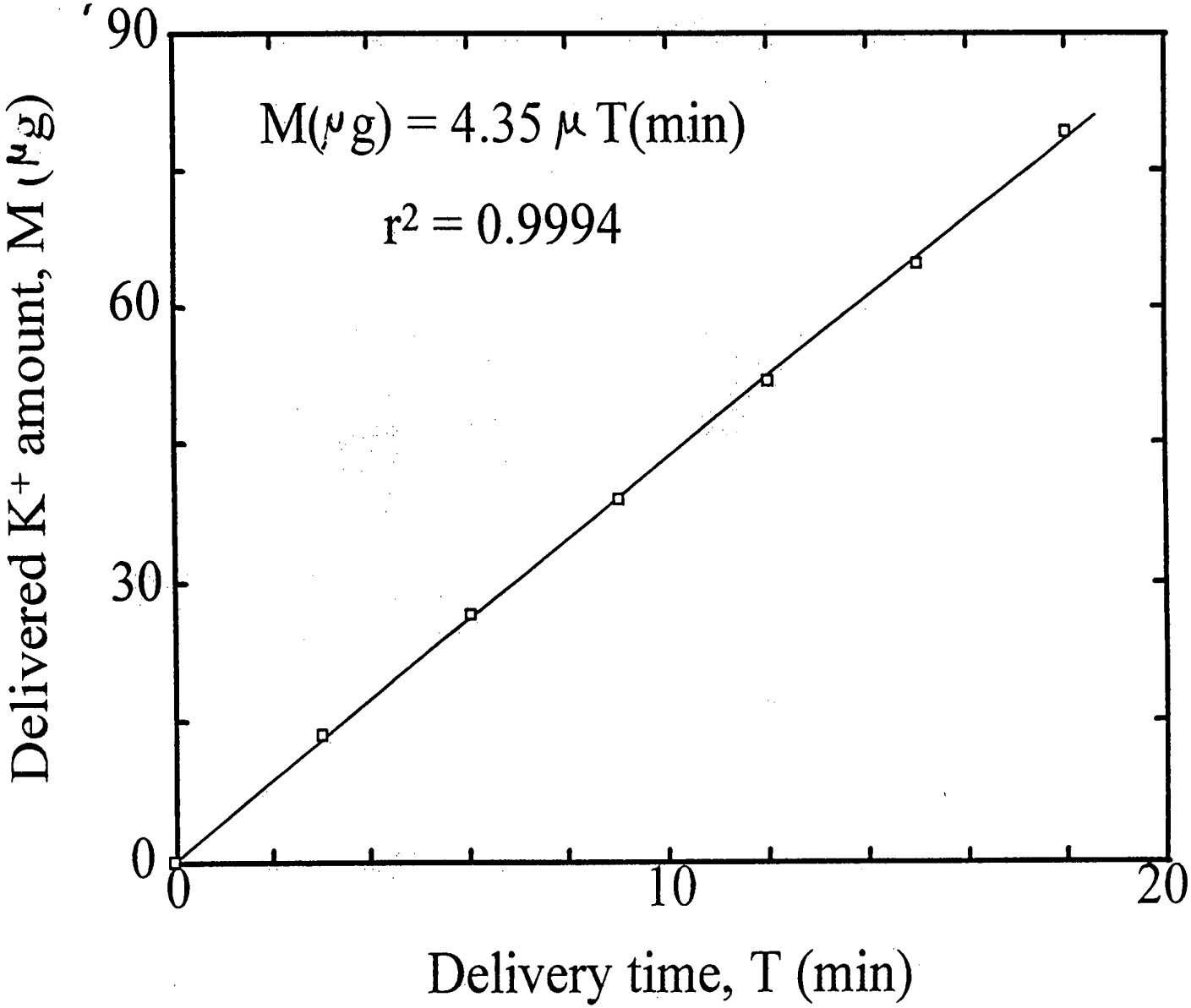

90
60
30
0
0
10
20
M(μg) = 4.35 μ T(min)
r2 = 0.9994
Delivered K+ amount, M (μg)
Delivery time, T (min)

FIG. 25

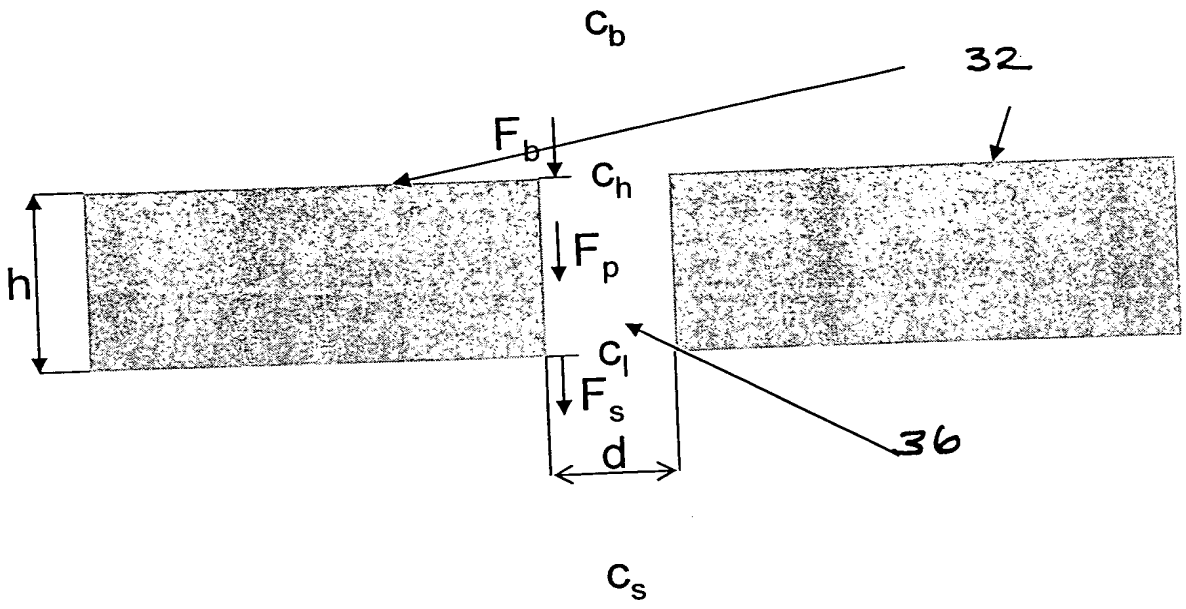


FIG. 26